Case Study

Year 2000 Preparation at Water and Wastewater Utilities

This case study report is part of a series of Year 2000 (Y2K) preparation case studies prepared for the EPA Office of Water and the State of California. These case studies review the process and status of Y2K preparations being performed by three water and/or wastewater utilities of varying sizes. The Y2K bug is the computer glitch that can cause computers and computerized equipment to not properly recognize the year 2000. For many years computer programmers used only the last two digits of the year when writing the date into computer code. When the year changes from 1999 to 2000, computers may read the year as 1900. As a result, computers and computerized equipment may shut down, malfunction, or simply perform business as usual. Computers that perform business as usual may encounter problems at other dates, however, such as February 29 (the year 2000 is a leap year, but 1900 was not). See the Appendix for a list of dates with possible Y2K problems.

The Y2K bug can affect numerous systems in water and wastewater utilities. Not only can the computer systems monitoring and controlling plant operations be non-compliant, but much of the plant equipment can also be non-compliant. Many devices, such as electronically controlled pumps and valves, may have computer chips embedded in them that have an internal clock. Sometimes this clock will show up on a digital display on the device, but many times it cannot be seen at all. In addition to all the embedded operating systems and computer controls, utilities have business-related computer hardware and software that can be affected, and they rely on vendors and suppliers who must also cope with Y2K issues.

With the vast amount of work that must be performed to prepare water and wastewater utilities for Y2K and the limited time in which the work must be done, these case studies are designed to assist utilities that are not as far along in their Y2K preparations. The utilities featured in these case studies are considered to be leaders with regard to the amount of work they have done to prepare for the Y2K bug and their progress toward finishing preparations. In their preparations, these utilities have learned from their experience, and these case studies are intended to pass on this knowledge.

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1. SYSTEM OVERVIEW

The Eastern Municipal Water District (District) is a medium-sized water and wastewater utility in southern California, about 90 miles east of Los Angeles. The District was formed in 1950 to secure water for the drought prone area. Its service area comprises about 550 square miles, and serves a population of 419,000. The District is governed by a 5-member Board of Directors who are elected by local voters to four-year terms.

Most of the District's water comes by aqueduct from the Metropolitan Water District. The remainder, a little under one third, comes from District wells. Seventy-three storage tanks in the District hold almost 162 million gallons of water. In their 1998 fiscal year, the District delivered an average of 55 million gallons per day (MGD) of water to 78,000 customers, and eight other water agencies. About 7 percent of this water was used for agriculture. The water treatment process consists chiefly of chlorination, although they also perform some iron and manganese sequestering on well water. Many of the controls in the plants are automated, but all have manual overrides.

The District's wastewater system consists of five treatment plants, over 1,100 miles of sewer lines, 35 lift stations, and about 129,000 connections. Their treatment plants have a combined capacity of about 49 MGD. In 1998, the District sold approximately 5.2 billion gallons of tertiary-treated reclaimed water for agricultural purposes. As with the water treatment plants, all controls in the wastewater treatment plants have manual overrides.

About 40 percent of the District's $116 million in revenues in 1997 was from water sales, another 20 percent was from sewer service charges and reclaimed water sales, and the remainder was made up by non-operating revenues such as taxes, fees, and interest. Total expenses for the period equaled $108 million, $88 million of which was used for operations.

2. MOTIVATING FACTORS

The District began planning for the Y2K problem in 1995 and has invested a great deal of time and resources on the project since. The District has had several factors motivating it on this project. If the District did not prepare for Y2K, the results could be disastrous. Sewage could flow in the streets or back up into people's homes, and water could cease to flow, could go untreated, or could be contaminated. All of these scenarios pose major health and environmental risks. The District recognizes the trust placed in it by the community, and could not allow risks of this nature to go unabated.

What is most important to the District, though, is its mission, which is "to provide safe and reliable water and wastewater services to [its] community in an economical, efficient, and

responsible manner, now and in the future." If the District is not completely thorough in its Y2K preparations, then it can not fulfill its mission of "safe and reliable" services.

The District is also motivated by regulations that it must adhere to. The California State Department of Health and the California State Water Resources Control Board regulate water and wastewater utilities in the state, and will not allow any regulatory exceptions for Y2K issues. If the District encounters problems, it can be found out of compliance with its permits, just as it would at any other time. EPA also oversees water and wastewater utilities, and they also expect nothing less than business as usual on Y2K dates.

3. GENERAL Y2K PROCESS

3.1 Education and Awareness Building

The District first recognized the need to address the Y2K problem in 1995. At that time little was known about the issue. After a period of awareness building among managers, the Y2K problem was identified as an issue that had to be formally managed. In 1996 the Y2K Readiness Program, dubbed "The Cinderella Project," was formed. It was decided that instead of forming a separate team to address an issue that affects all aspects of the District, they would use the existing organizational structure, and formalize an executive committee consisting of the heads of each department (14 in all). They also decided to actively involve the Employee's Association to obtain assistance in the assessment of potential Y2K problems and receive their input for critical activities, including contingency staffing during the rollover. They discussed retaining an outside consultant to assist with Y2K preparations, but after careful review, including a series of consultant interviews, they decided that they would only need outside consultants for independent verification and validation.

To help educate the executive committee about Y2K, and to aid in coordination and planning, a new Director of Information Systems was hired, with advanced business degrees and private sector experience. He spent several months educating the executive committee on how the Y2K bug could affect the District. At first, many of the committee members were unaware of the potential impact that Y2K could have. The natural denial that some people experience regarding future problems had to be overcome. As a result of spending time on this awareness building, everyone at the District is now informed about the Y2K issue and supportive of all efforts to address the potential problems it could create.

3.2 Y2K Project Organization

The District's organization is functional in nature. This means that the activities of one department may not be closely integrated with the activities of other departments. Even though the Y2K Readiness Program is organized around the existing organizational structure, it was realized early on that the functional/departmental approach to resolving the Y2K issue would result in unidentified problems, and inconsistently applied solutions. The reason the program

was organized around the existing organizational structure is because the various departments have an ongoing responsibility to provide "safe and reliable" water and wastewater services, which they have historically fulfilled. However, the recognition that the functional/departmental approach to the Y2K issue would lead to unacceptable outcomes, coupled with the recognition that the work groups traditionally responsible for various activities needed to sustain that responsibility, prompted a need to take a different approach. This led to the adoption of a Total Quality Management (TQM) approach. As a result, all aspects of the utility became involved. Even the Employee's Association took on major responsibilities in ensuring that the employment memorandum of understanding had language to enable Y2K preparations, contingency and remediation.

Each committee member has complete responsibility for Y2K assessment and remediation in their area of responsibility. Under each committee member are project leaders (49 in all). Each project leader manages a project team, which addresses specific aspects of the overall Y2K project. Committee members have found this organizational structure beneficial because it maintains responsibility within each member's area of authority and includes input from all employees. The Employee Association is serving as a catalyst for involving employees throughout the process. Even though the Information Systems Department has its own Y2K issues to resolve, it also serves as a resource and facilitator to ensure the overall Y2K program's success.

The Y2K executive committee has been meeting every-other-week to monitor progress and discuss newly recognized Y2K issues since mid-1998. The primary purpose of the committee meetings is information sharing and problem solving. Much of the actual decision making is left up to the individual project teams. Each project team determines the tasks that they will need to complete to prepare their area for Y2K. Every task is then reported with its projected time line from start to finish. During weeks when the executive committee does not meet, Project Tracking Software is updated on the progress of each task. This way, if any tasks are not being completed according to schedule, necessary adjustments to schedules, resources, or approaches can be taken. This process of constantly updating the project schedule with distribution to all department heads sustains visibility of the program, and allows everyone to monitor progress.

The District hired external consultants to perform an independent audit of the Y2K Program and the outcomes of remediation efforts. External consultants were hired, rather than utilizing the District's own staff, to ensure that the audit process would be performed objectively. The consultants performed independent verification and validation of the District's control and communications systems and were helpful in two ways. First, they assessed the Y2K Program design, activities, and results, and reassured the District that it was on the right track. They found very few items that were non-compliant, and those that were non-compliant were already being fixed. The consultants did make the District aware of one oversight, though. They found that by not documenting their Y2K preparations thoroughly enough, the District was making itself susceptible to potential legal liability should any Y2K related problems occur. The consultants

helped improve documentation standards to prove that due care was taken with the Y2K Program.

3.3 Funding the Y2K Project

Almost all of the District's Y2K related expenditures were long-term investments that not only increased their Y2K readiness, but also created significant returns on investment or improved the District's emergency preparedness program. Therefore, very little was actually spent solely to repair non-compliant systems.

Despite utilizing existing funding sources, major expenditures continued to be managed through existing acquisitions channels. This is one example of utilizing the existing organization to manage the wide range of Y2K issues. The Purchasing Department was very involved in Y2K preparations and was fully aware of the issue's importance. They aimed to process all Y2K related expenditures early, in case demand outstripped supply of critical items, such as generators, and by January 15 they had processed all of the major Y2K-related purchases.

The District considered tracking all Y2K-specific purchases and labor from the beginning so that they could determine a total cost for the program. However, they decided that this would be unnecessarily burdensome since they would probably never encounter a project like this again so they would have no need to collect Y2K expenditure data outside of the normal day-to-day processes. Moreover, due to the empowerment of the project teams working on various aspects of the program, no centralized repository of Y2K purchases was maintained. Consequently, for the purposes of this report, they have only estimated Y2K related costs. In February of this year, the District estimated that it had spent $1.4 million on Y2K-only items, meaning that without the Y2K issue, the District would not have spent this money. They estimated that they spent another $2.2 million on tasks that fixed someY2K problems, but benefited the District in other ways, or would have been performed at some point regardless. Neither of these estimates account for labor, or supplies ordered as part of day-to-day operations.

4. Y2K REVIEW OF OPERATIONS

Each of the District's systems utilized for either water or wastewater operations were reviewed independently. Even though the review methods were determined by the assigned project teams, with consultation as necessary by the appropriate members of the Y2K executive committee, the reviews were prepared in substantially the same manner, with the specific review processes being nearly identical. First, they inventoried everything that could possibly be affected by Y2K. Second, they inspected each piece of equipment in the inventory (taking housings apart as necessary) to obtain appropriate manufacturer and model number information. Third, they went through the complete inventory and assessed whether the items on the list were compliant, usually by contacting the manufacturers directly or indirectly by searching manufacturer web sites. Finally, they replaced every item for which they could not assure Y2K

compliance. The District decided to replace non-compliant components rather than repair them because they believe that computer modification or repair is outside of their area of expertise.

Throughout the operations review, energy was and is an important concern. Without electricity and/or natural gas, water and wastewater treatment will cease. Therefore, the District has been developing contingencies should their supply be disrupted. These issues are discussed in more detail later in this report.

4.1 Water Systems

4.1.1 Inventory

The Water Operations Director began the review of the water systems by leading project teams that inventoried every piece of equipment in the system that runs on electricity. This initial inventory was very large, so before moving on to the assessment phase, the teams learned more about embedded chips and which equipment was likely to contain the chips, and then they reduced the list accordingly.

The scaled down list was still a comprehensive evaluation of items that could be affected by Y2K, but it was now a more manageable size since it did not include things such as electric lights. The inventory included the Supervisory Control and Data Acquisition (SCADA) systems and the Programmable Logic Controllers (PLCs), which monitor water systems operations. All electronically controlled equipment in the treatment plants and outside the plants at pumping stations were also included in the inventory. Once the inventory list was complete, the Water Operations Y2K Project Teams started the assessment and testing phase.

4.1.2 Assessment/Testing

To assess the Y2K compliance of all of the items in the inventory, the Water Operations Y2K Project Teams physically searched through all of the treatment plants and other water-related systems for the inventoried items. They then recorded the manufacturer and model number of every item. Most manufacturers had web pages that included statements about the compliance. Manufacturers that did not have web pages were contacted directly. In every case they obtained documentation from the manufacturer as evidence of their due care in determining Y2K compliance. Items that could not be traced to an existing manufacturer, or for which a manufacturer would not guarantee Y2K compliance, were replaced.

The computerized management components of the District's SCADA systems were non-compliant. However they were already being upgraded as a matter of normal business. The District feels that this is a good example of the value of the TQM effort and the utilization of existing organizational structures to accomplish a major program, such as their Y2K Program. They also found that two of their back-up generators were non-compliant and had to be renovated. Interestingly, during the assessment process they found that a back-up battery system for one of their sites was compliant, but the batteries had to be replaced because they had passed

their expiration dates. Had the District not performed its Y2K assessment, it may not have encountered this problem until it experienced an electrical outage and found that the batteries no longer worked. This is just one example of the many times that the Y2K Project has made the District aware of non-Y2K problems that they may not have otherwise found.

4.1.3 Remediation

Since the District began replacing PCs in 1995, and the SCADA systems upgrades were part of normal business operations, the only remaining Y2K issue was the renovation of the generators. The generator renovation was quickly implemented.

4.2 Wastewater/Water Reclamation Systems

4.2.1 Inventory

The wastewater system includes five treatment plants, performing primary, secondary, and tertiary treatment, and 35 lift stations. The Y2K project teams began their review of the wastewater systems by inventorying every piece of equipment in the system that ran on electricity. This initial inventory was very large, so, just as in water operations, the Y2K project teams learned about embedded chips, and then they reduced the list accordingly. Each treatment plant manager then took this list as a guide, and performed a more detailed inventory of their plant. Generally, the managers broke the plants into components identified by motor control centers, and investigated each of these components.

There are five separate Distribution Control Systems (DCSs), one at each plant, and many PLCs, all of which had to be checked. The DCSs are similar to the SCADA systems utilized by the Water Operations group. All electronically controlled equipment in the treatment plants and outside the plants at pumping stations were also included in the assessment.

4.2.2 Assessment/Testing

To assess the Y2K compliance of all of the items in the inventory, the Water Reclamation Y2K Project Teams physically investigated each motor control center in the wastewater system. They recorded the manufacturer and model number of every piece of equipment. Most manufacturers had web pages that included statements about the compliance of all of the models they make/made. Manufacturers that did not have web pages were contacted directly. If manufacturers could not be contacted or would not certify a device they produced as Y2K compliant, the device was replaced. In every case they obtained documentation from the manufacturer as evidence of their due care.

At one of the District's wastewater reclamation plants the operators also tested equipment by forcing critical Y2K testing dates into controllers. They encountered no problems, but this was not surprising since most of the equipment is relatively new and from reliable, brand name manufacturers.

4.2.3 Remediation

The Distribution Control Systems are in the final stages of being upgraded to compliant versions, although, as was stated earlier, this process was begun before the Y2K project.

4.3 Engineering

4.3.1 Inventory

The Engineering Department does about $40 to $50 million worth of construction every year. To aid their designs they have a mapping computer, GPS, and many other pieces of equipment, in their office, and in the field.

4.3.2 Assessment/Testing

For the past two years they have required that every new piece of equipment purchased be certified as Y2K compliant. To test their equipment they forced dates forward and tested for problems. They found no Y2K problems with this approach, but realized that it was not a stringent enough test for some of their more critical and complex pieces of equipment, such as their mapping workstation. Therefore, they are currently running more stringent, controlled tests following a specific Y2K testing procedure.

4.3.3 Remediation

Since the engineering department has encountered no Y2K compliance issues, they have not had any need for remediation.

4.4 Environmental Compliance

4.4.1 Inventory

The Environmental Compliance Department oversees the District's monitoring and laboratories, and assists the District in meeting its goal of environmental protection. Even though the Environmental Compliance Department inventoried all of the computerized equipment in the laboratory, most of their review was dedicated to external influences. The District has a contract with one external laboratory whose compliance was assessed. Moreover, the District has several industrial customers that discharge to the sewer system. These industrial "dischargers," as they are termed, have processes that must also be assessed.

Industrial dischargers were included in the Department's inventory because the wastewater treatment system is designed to only treat "normal" wastes. The District's facilities are not configured to treat hazardous wastes, so these are normally removed from the discharger's effluent stream by on-site pretreatment systems before wastes are released to the

District's sewer system. If a discharger encountered a Y2K problem in a pretreatment system that causes them to exceed discharge limits, the District's treatment system could be disrupted. Even though this scenario may not have a high probability of occurrence, the pretreatment systems were assessed to assure that no problems would occur.

4.4.2 Assessment/Testing

In assessing the status of the laboratory equipment, they found that the software in a laboratory instrument known as an Ion Chromatograph was not compliant. All other equipment was compliant, though. The contract laboratory certified that all of their equipment was compliant, and since the District has sustained a long-term, close working relationship with the lab, the District accepted their certifications.

To assess the Y2K readiness of industrial dischargers, the District mailed a letter to each of them requesting a statement on compliance. The letter also let the dischargers know that there will be no allowance for regulatory violations for problems caused by Y2K. If they exceed discharge limits, they will receive monitory fines as with any other time, and, as always, they should alert the District of any permit violations immediately. For larger dischargers, the District has been following up with site visits so that they can talk in person about Y2K preparations and can observe all remediation activities and contingency plans.

In addition to assessing the threat of industrial discharges, the Department also looked at other dischargers and sources of contamination. For example, one scenario they examined was the possibility that many home and commercial water softening appliances would flush their backwash and release brine into the sewer system at the Y2K rollover. The treatment system can handle some brine, but it would not be able to meet discharge limits if too many of the water softeners released it at the same time. After some research, however, they found that this was not an issue.

4.4.3 Remediation

To fix the software in their Ion Chromatograph, the District installed a Y2K compliant version of the software.

4.5 Communication Systems

4.5.1 Inventory

The communication systems for both operations and business are discussed here. Telephone systems, cellular telephones, pagers, two-way radios, computer networks, and the Internet are all used to link operators and administrators together and with the outside world. All of these systems are complex, and any of them could potentially have Y2K problems. Each system was analyzed by its various components, such as the telephone switches and the

telephones themselves, since different components of a system could have different manufacturers and different compliance statuses.

Unlike other system reviews, a single department did not review the communication systems. The Information Systems Department reviewed most communication systems, but other departments and project teams also reviewed the communications equipment in their sector, and information was shared through members of the executive committee.

4.5.2 Assessment/Testing

Communications equipment was assessed in the same manner as other equipment. The manufacturer and model name of each component was recorded. The compliance of each component was then determined by searching manufacturer web pages for Y2K information on the model, or by contacting the manufacturer directly.

Since communication depends heavily on external service providers, much of the assessment process depended on determining whether the providers were ready. All providers, such as phone, cellular, and paging service providers were sent letters inquiring about their Y2K readiness. Each stated that they would be ready, but the District had to decide whether they could believe their statements. Providers of the more critical systems were pursued to develop a higher level of confidence in their statements.

Some aspects of the phone system were found to be non-compliant. For example, the voice mail system needed a software upgrade. Another piece of communications equipment that was found to be non-compliant was the trunked radio systems manager. Based on a very old computer platform, the radio system manager needed replacing.

4.5.3 Remediation

The voice mail system was upgraded by the service provider for the telephone systems. The trunked radio system manager is currently being replaced.

5. BUSINESS SYSTEMS

5.1 Basic Business Hardware and Software

5.1.1 Inventory

The business hardware and software inventory included more than 100 software applications, and took weeks to complete. The business systems analysts developed a database of every distinct application, including the smaller applications that employees had made. They also inventoried all of the computers, and peripherals such as printers, scanners, and copiers.

5.1.2 Assessment/Testing

Assessment was started in the summer of 1995. The business systems analysts went through their database of applications and checked each one until they had all been labeled as compliant, non-compliant, or currently being upgraded. Compliance was assessed by testing software and reviewing programming code. They also performed some system analysis by testing several software and hardware items together and observing their interactions.

Non-compliant PCs were already replaced and operating systems were already upgraded. However, many of the business systems needed to be upgraded to handle Y2K issues. Moreover, many of the systems no longer adequately supported business functions. So the District took the opportunity to revamp many of their business systems. They found many small Clipper software applications that employees had made, which were non-compliant, and which no longer serviced the District well. They also found that some major applications, such as the payroll system, investment management software, and billing system, were non-compliant. The hand-held meter readers, used to record customer meter levels, were also non-compliant, but were already in the process of being replaced.

5.1.3 Remediation

Business hardware required little remediation. Most of the District's PCs were upgraded in 1996/97, at a cost of about $272,000. However, even after the completion of that intensive effort they found a few computers that were not compliant. For example, one computer ran the headquarters building security system. Once the security system was implemented on a newer computer, it was compliant.

Business software needed extensive remediation. To implement software remediations, a process is followed that allows for input from the users as well as the systems analysts. After determining that an application is non-compliant, the systems analysts evaluate their options and make a recommendation to the primary users as to whether the application should be upgraded or replaced with something new. The users have to sign off on the recommendation before the systems analysts can take any action. If there is a database associated with the system, the database managers must also sign off on any changes that the software would have on the database. If one group does not sign off on the systems analysts' recommendation, no changes are made until an agreement can be established. The recommendation then goes to the Change Management Board and Database Committee for ultimate approval.

One software replacement that met with some resistance was the replacement of their Clipper software with S.P.O.R.T. Clipper software allows users to make their own small applications that work with Clipper to fit their needs. Clipper was becoming obsolete, but replacing it meant that the many personalized applications that employees had made would be lost. It was ultimately decided, though, that it would be too burdensome to try and upgrade all of the applications to a compliant status. The S.P.O.R.T. software was the single most expensive

Y2K related expenditure, costing over $1.5 million. As with other expenditures, though, this was a long-term investment that affected more than just Y2K readiness.

The other main software remediations, many of which are still being performed, are for their human resources, billing, and financial applications. Their human resources/payroll software, as well as the District's Oracle ERP, were upgraded to a current releases. This was one of the largest expenditures that was performed solely for Y2K compliance reasons. In most cases software was replaced or upgraded to become more efficient, and Y2K compliance was a side-benefit, but the financial software was an exception. The Financial Department's central software and investment management software both had to be replaced solely because they were non-compliant. Some of the financial software upgrades had to be coordinated with the banks, who are also involved in Y2K projects of their own. The District must, therefore, continually keep abreast of their banks' information system changes, and respond accordingly.

6. PUBLIC RELATIONS

The Community Involvement Department has been preparing for Y2K by keeping their customers and the local public informed. They have no local television coverage, and little radio, so they rely mostly on direct mail for public relations. They have been including articles about the District's Y2K preparations with their billing every other month since October 1998, and will continue through December 1999. They are also including brief statements about Y2K in every presentation or speech District personnel give, and they make regularly updated fact sheets available to the press, which detail the District's progress.

Perhaps as a result of their efforts, they have received a surprisingly low number of inquiries. As of May 1999, they had received only 18 phone calls and 80 letters specifically concerning Y2K. They have not counted the number of inquiries that have accompanied phone calls concerning bills or other issues, though. These calls are handled by their customer service representatives who are prepared with some Y2K "talking points" and are briefed on how to respond to Y2K inquiries. When customers are on hold while waiting to talk with representatives, they hear recorded messages, one of which now concerns Y2K. The District also has a standard letter that is sent to customers who inquire about Y2K, which states that the District will be as prepared as possible for Y2K, but that it cannot guarantee that there will be no minor problems.

The District has made an effort to communicate more personally with its largest customers. They sent a letter to their 300 largest customers letting them know that they are doing everything they can and that they expect that there will be no disruptions as a result of Y2K. They are also urging these customers, which include sub-agencies that buy their water from the District, to check all of their equipment, and to talk with the District's information technology specialists if they have any technical questions.

The Community Involvement Department coordinates with the Information Systems Department to communicate Y2K information to employees. Employees must be well informed to understand how Y2K affects their individual jobs, and how it affects them personally. One of the ways they have kept their employees informed is by writing Y2K articles for every bimonthly employee newsletter since December 1998.

7. EXTERNAL INFLUENCES

The District can prepare its own systems as much as possible, but if its suppliers encounter Y2K problems the District will have a difficult time performing business as usual. Therefore, the District has been contacting its suppliers to determine their readiness.

All suppliers have reported that they will be prepared for Y2K, but the District understands that some of these statements may not be reliable. Additionally, the District cannot reliably differentiate between the statements that can be trusted and those that cannot. Therefore, the District has decided that it must assume that any of its suppliers could encounter some problems.

However, the District does not want to upset the relationships it has with its suppliers by ordering large amounts of supplies in December, and then not ordering again for months. So the District has struck a balance, deciding that it must be totally self-sufficient for three days. Some parts of the District's operations, because of their nature, will be self-sufficient for a much longer period of time, but all will be self sufficient for at least three days. This should give them enough time to evaluate what the specific supply problems are and how to circumnavigate them. Hopefully, this will also give their suppliers enough time to work out any problems they have.

The District also depends on businesses that do not supply the District operations on a day-to-day basis, but are important nonetheless. Benefits providers, such as insurance, healthcare, and 401(k) providers, need to be assessed for Y2K readiness. In case employees are injured while working on critical Y2K dates, area hospitals are also being assessed. Not only do the District's banks need to be assessed, but their armored delivery service must be too. Other delivery services, such as UPS, are also being assessed, as are all the District's communication providers.

8. Y2K CONTINGENCY PLANNING

Although the District expects to be as prepared possible for the Y2K bug, they acknowledge that there could be some problems that could escape detection or could be outside of their control. Therefore they are developing a contingency plan that covers all of the potential problems that could arise from Y2K. The District already had contingency plans for earthquakes and other disasters, so they are modifying these to create one tailored specifically to Y2K.

8.1 Human Resources

An essential part of the District's contingency plan is preparing and organizing their staff so that they are ready to handle any event in an emergency. The District's Employee Association has been extremely cooperative in working with the District in evaluating Y2K issues and preparing the employees for the rollover date. The Association and management have seen the Y2K issue as an opportunity to work together to ensure that the District accomplishes its mission in a time of potential difficulties.

For staffing at year-end, the District has strongly discouraged any vacations at the end of December or the beginning of January, but has not forbidden them, as some employees made plans and financial commitments long before the District stated its position. Each department may make its own, more stringent vacation restrictions, though.

For the night of December 31, the District has not yet decided whether they will hold a get-together at headquarters in order to gather staff for the Y2K rollover at midnight. This option currently looks likely, but they are still discussing whether families would be invited or not. Since the headquarters could become an emergency command center for operations in the event of significant problems, the presence of families could hinder operations.

Key employees will be on call, however, as each department dictates. Each plant will have two person teams to monitor operations, maintenance people will be ready to respond to energy needs with mobile generators, and administrative personnel will be ready to contact their staff if necessary. The District has an office in their headquarters that is prepared as an emergency command center, which will be in full operation on New Year's Eve. From there they can communicate with field staff through various channels, and they have emergency response plans ready to direct staff. They will also have a list there, which the Human Resources Department has prepared, of every employee and their skills and certifications, so that they can effectively take advantage of staff abilities. From the emergency command center they can also watch televised reports of how Y2K is affecting areas in time zones to the east to help gauge how it will affect them.

8.2 Energy Contingencies

Since most of the District's water supply is gravity fed from an aqueduct, their upstream water supply will not be greatly affected by power outages. All of the treatment plant controls have manual overrides, so, although staffing would be difficult, much of the treatment process could be performed without electricity. However, water distribution would be impossible without power. Most areas have over 24 hours of water supply without any pumping but some have as little as two hours. The wastewater treatment side has even less capacity. Most sewage lift stations would overflow in half an hour without pumping. Therefore, they plan to have back-up generators ready for any power outages.

The District already had many generators, but the potential for blackouts across their entire service area with Y2K made them reassess their generator plan. They already had permanent generators at all of their facilities, with automatic switches that start the generators immediately when the power goes out. The District also had many permanent and mobile generators for their 72 water pumping stations and their 35 wastewater pumping stations. All of these generators undergo full-load tests every month. After evaluating their generator needs in preparation for at least three days of self-sufficiency, they found that they needed two more mobile generators and four more fixed generators. They also found that to cut down on set-up time for mobile generators, they needed a "quick-connect switch," which allows for fast generator hook-ups, at each pumping station that does not have a fixed generator. Since generators are estimated to be in high demand prior to the end of the year, the generator assessment was started last fall. All purchase requests were made by the beginning of this year since it often takes four to five months to get a generator from the time of purchase.

The District has lower electrical demands than other utilities of similar size because it uses natural gas extensively for pumping. In most places the natural gas is backed up by generators. The District looked at the possibility of their natural gas supply being disrupted by Y2K and found it to be very unlikely. They could still run critical operations in the event of both their electrical and natural gas supplies being cut, and they have a plan for this contingency, but they have concentrated their planning for a three-day electrical outage only.

All of these generators require large amounts of fuel, as do the trucks transporting mobile generators and workers. To accommodate these needs, the District has made a fuel assessment to fit their contingency plan for a three-day outage. On December 29, they plan to top off all fuel tanks in the District. Most of the District's fuel needs are for diesel, although they also have some unleaded gasoline needs. They have a total diesel storage capacity of about 24,000 gallons and a gasoline storage capacity of about 10,000 gallons. They have also contracted with their fuel supplier to have a stand-by tanker truck at their headquarters with 8000 gallons of diesel fuel on December 31, for as long as is necessary. They first talked with their fuel supplier about reserving this truck in January 1999, knowing that fuel might be in high demand at the end of the year because of Y2K. At this time the fuel supplier had not received any Y2K related fuel requests from any other customers. The District asked for the supplier's guarantee that it could supply fuel to top off all tanks on December 29, and that the fuel truck would be standing by on December 31. The supplier said that the District would be its highest priority, but also stated that if there were any Federal directives for it to do otherwise due to fuel emergencies, those would take precedent. If the District needs more fuel than the 8000 gallons in the tanker truck, there are many refineries in the area that the truck can go to for refueling, and the District feels confident that at least some of them will be operating after the rollover.

8.3 Supplier Contingencies

The District has a large maintenance building that usually has at least three weeks worth of general hardware supplies, so they do not feel that they need to stockpile any more of these. Their only other critical operations supply is chemicals for water and wastewater treatment. The

District uses ten different chemicals, and they are currently assessing how much they will need for three days of self-sufficiency. They plan to be finished with this assessment by June 30. As was stated earlier, they do not want to disrespect vendor relationships by stockpiling large quantities of chemicals. They will be sure to have at least three days worth of chemicals on December 31, and if they believe they can stockpile more of some chemicals without hurting vendor relationships or wasting any chemicals, they will do so.

8.4 Finance

The Finance Department has been working closely with all of its banks and financial services providers on the Y2K issue, and believes that they will all be prepared. In case they are not, though, they have planned some contingencies. Several months ago they began moving all major scheduled transactions, such as bond payments, away from the last week in December and the first week in January. They also plan to print checks for all accounts payable late in December. They can then keep these checks in a safe until they are due. If they lost the ability to print checks temporarily, this plan will at least give them some time to work out the problems. If they need more time they feel confident that they have enough staff to write checks and do the accounting manually.

9. REMAINING Y2K TASKS

Most of the District's tasks in preparing for Y2K have already been completed, and almost all of the tasks that are not on-going will be completed this summer. As of early June, there were still some remaining tasks in their assessment or remediation phases, which are described below.

In the water and wastewater systems there were still a few remaining hardware and software elements that needed to be assessed. In one of the wastewater plants, the SCADA needed to be upgraded to a Windows NT compatible version. At the pumping stations, most of the quick-connectors still had to be installed. In the laboratory there was some testing of equipment left to be performed. The Environmental Compliance Department also had some industrial discharger site inspections remaining. For communications, as was stated earlier, the non-compliant trunked radio systems manager needed to be replaced.

There were also some unfinished tasks in the business systems. This included some computer hardware and peripherals assessment, but most of the tasks related to software remediation. Some of the smaller specialty and custom software had not yet been upgraded or replaced. Much of the work on the financial software, such as Oracle and the investment management software, had been completed, but there was still some work left. The Financial Department also had the on-going task of keeping abreast of bank system changes. As computer systems are upgraded and changed, the systems are tested to assure that they are working properly and are, in fact, Y2K compliant. The Community Involvement Department also has on-going tasks in keeping customers, local residents, and employees informed about Y2K.

The chemical needs assessment will be finished soon, and the contingency plans are currently being written. The general outline of the contingency plan is complete, but there are some details remaining to be worked out. Once the contingency plan is written, emergency exercises will be planned and practiced and the contingency plan will be revised as necessary. Overall, the District is very confident that all preparations will be completed in time for Y2K.

Appendix - Critical Y2K Dates

DATE	REASON FOR CONCERN
01/01/1999	Systems that look one year ahead may fail.
04/09/1999	Special-use Julian date (99th day of the 99th year).
07/01/1999	Many governments begin their fiscal year.
08/21/1999	Global Positioning System date rollover affects military, transportation, Geographic Information System, and Automatic Vehicle Locator.
09/09/1999	Programmers use 9999 as an end of file or infinity; will cause numerous problems (ninth day of the ninth month of the 99th year).
10/01/1999	Federal government and others begin FY 2000.
12/31/1999	End-of-year baseline (to be used in rollover scenario).
01/01/2000	Date rollover will halt, confuse, or otherwise disrupt many systems and devices.
01/02/2000	First 24-hour look back period.
01/10/2000	First date requiring full use of seven digits.
02/28/2000	Day prior to Leap Year (to be used in rollover scenarios).
02/29/2000	Many systems will not recognize Leap Year in 2000.
02/30/2000	Invalid date. Test to ensure that Leap Year logic is functioning.
03/01/2000	First valid date after Leap Year.
10/10/2000	First date requiring full use of eight digits; may cause failures.
12/31/2000	Some systems using Julian dates may not recognize the 366th day of the Leap Year.
01/01/2001	First date in 2001. Check rollover functions.

Sources: Texas Guidebook 2000 and California Year 2000 Embedded Systems Program Guide.